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DEFOLIATION OF TIMBER STANDS
WITHIN THE YELLOWSTONE NATIONAL PARK

by

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Forest Insect Field Station
Coeur d'Alene, Idaho
October 5, 1923

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INDEX

Sub-Titles	Page
INTRODUCTION	2
INFESTATION AREA	3
INSECT RESPONSIBLE FOR INJURY	5
HISTORY OF SPRUCE BUDWORM EPIDEMICS	6
SECONDARY INSECTS AND DISEASE	8
FUTURE OF SPRUCE BUDWORM EPIDEMIC	9
BARKBEETLES	11
SEASONAL HISTORY STAGES OF THE SPRUCE BUDWORM	13
DOUGLAS FIR LIMB DEFOLIATED BY THE SPRUCE BUDWORM	14
DOUGLAS FIR TREE SHOWING TIPS OF LIMBS DEFOLIATED	14
BLACKTAIL DEER CREEK SHOWING DEAD SPRUCE KILLED BY BUDWORM	15
CRESCENT HILL SHOWING ELEVATION TO WHICH INFESTATION HAS REACHED	15

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INTRODUCTION

During the season of 1923 an examination was made by the writer of this report of an area within the Yellowstone National Park where the superintendent had reported a large per cent of the spruce trees as being killed by defoliating insects. The purpose of this examination was to determine the insect responsible for the damage, the extent of the infestation, and the possibility of artificially checking the epidemic. During the season visits were made to this area in June, July and August. During July a very hasty trip was made through some other areas of the park to determine the status of the barkbeetle infestation within the lodgepole pine stands. The purpose of this report is to give to the interested parties the general information secured by the examination, however it was fully realized that from an economic viewpoint it is of little value as it carries no recommendations for the control of the insect which is destroying the scenic value of the park.

INFESTATION AREA

From reports of the Park Service officers this epidemic started on Blacktail Deer Creek about five years ago, and since that time has spread up the Yellowstone River a distance of approximately 8 miles to Garnet Hill. The infestation extends up all of the tributary streams for varying distances and has ascended the mountain sides from one to three-quarters of a mile. Up Hellroaring Creek, which is a rather large stream, the infestation has spread several miles and is now in the spruce stands of the Absaroka National Forest.

This area is fairly heavily stocked with mature Douglas fir and Engelmann spruce. The stand varies in age from 100 to 150 years and more. The soil is not of a very good quality and the stand is broken up with many sagebrush parks, or openings. There is but very little forest reproduction throughout this area, with the exception of some of the higher mountain sides and plateaus which support the heaviest timber type, considerable young growth is found.

Throughout this area approximately 8 per cent of the total volume of timber has already been killed. This loss varies in different parts of the region from a very small per cent to a 75 per cent kill on 50 to 100 acres or more. As a result of this year's defoliation this loss will be materially increased. The damage is most severe along stream bottoms in the moderately open forest type, and rises to the higher elevations very slowly. The spread of this epidemic in this region has been an apparent broadening of the area infested in order to secure sufficient food material. The entire stand is attacked with the exception of trees isolated in openings which in many cases have escaped the ravages of this insect. Both the Douglas fir and Engelmann spruce are attacked with no preference between the young or old trees. However, the Douglas fir is preferred to Engelmann spruce.

On Blacktail Deer Creek where the infestation first started a large per cent of the timber has been killed by the total defoliation. It is not known how many years of defoliation is required to kill a healthy tree, however it is believed that it depends entirely upon the severity of the attack. If only the new growth is destroyed and the buds are not injured so that new needles can be produced the following season the tree will live for several years or as long as there are sufficient old needles to perform the functions of the foliage. In cases of severe attack where all the foliage is destroyed and the buds injured, one year's defoliation will no doubt result in the death of the tree.

The arbitrary boundaries that have been given for this epidemic do not include the entire area of infestation, which is no doubt many times larger, but just that region where the injury has been so severe that the limits are clearly defined. The exact boundaries of the area within the Yellowstone National Park where this insect is now established are not known. However, the caterpillars were found to be present all along the road from Mammoth Springs to Tower Falls and Lamar Canyon. There is very little evidence of the attack at this time but the insects are present and within a year or more these areas will no doubt be added to the severely damaged region described as the area of infestation.

INSECT RESPONSIBLE FOR INJURY

The insect responsible for the defoliation of the timber in this area has been determined by Mr. Heinrich, Specialist in Forest Lepidoptera, Washington, D.C., as the spruce budworm* (*Cacoecia fumiferana*). The small brownish moths are to be seen hovering around the trees early in August. Eggs are oviposited at this time on the under side of the needles which soon hatch into very small larvae. These larvae feed for a very short time, perhaps only sparingly, and then construct small cocoons in the crevices of the bark, under moss etc., in which the winter is passed. In the spring with the development of the buds these larvae emerge and attack the new growth. As the buds are opening the small larvae can be found in the heart of the tender needles where they have eaten their way. The larvae mature very rapidly and by the middle of July are nearly all full grown, at which time the transformation (pupal stage) to the adult moth takes place. The damage to the trees is done entirely by the larvae, and except for very severe attacks or a scarcity of food material the injury is confined entirely to the new growth.*

HISTORY OF SPRUCE BUDWORM EPIDEMICS

The earliest record of a spruce budworm epidemic in the United States is given by Dr. Packard, in which he presents the possibility that the widespread destruction of spruce in the Casco Bay territory in 1807 was due to this insect. Dr. A.D. Hopkins, Entomologist, U.S. Department of Agriculture, writes of the history concerning this insect as follows: "In 1878 to 1885 an invasion of this insect swept

*Figs. 2 and 3 show the manner in which the new growth is destroyed.

over the New England and New Brunswick woods and, aided by barkbeetles and disease, caused the death of a large percentage of the old spruce and fir. Then for about thirty years there was no evidence of its presence. Another outbreak developed in 1910, which continued its depredations in different areas throughout the north woods until 1921. Now it is claimed by experts who have made a special study of the insect and its depredations in Maine and Canada, that from 25 to 75% of the merchantable or older fir and a somewhat less percent of the spruce has been killed in Maine, New Brunswick and Quebec. Like the epidemic of about thirty years ago, the greatest abundance of the insects and the defoliation of the timber on any given area occurred during the first two or three years, after which the trees began to die and continued dying for five or six or more years, due largely to secondary causes such as root diseases and barkboring insects."

The first record that we have of this insect occurring in epidemic form in the west was secured in 1922. It is now known to be in an epidemic form at Priest Lake, Idaho, McCall, Idaho, and the Yellowstone Park.

SECONDARY INSECTS AND DISEASE

In the Blacktail Deer Creek area a large per cent of the injured trees are being attacked and killed by the Douglas fir barkbeetle.* However this attack is secondary to the budworm injury as only the weakened trees are being selected by the barkbeetles. Several trees were examined which showed a 1923 attack of this beetle on which all of the foliage had been eaten off by the budworms. In the northeastern United States barkbeetles followed the spruce budworm epidemics, causing the death of a large part of the weakened timber. At the present time these beetles are killing only such trees as are doomed as a result of the budworm defoliations, but there is a possibility that they will increase to such numbers that at the cessation of the budworm epidemic a primary barkbeetle infestation will be carried on which will destroy the remaining stands of Douglas fir. No insects were recorded working in the injured spruce. No evidence of disease was recorded on the injured trees.

FUTURE OF THE SPRUCE BUDWORM EPIDEMIC

To foresee the future of this outbreak of the spruce budworm is impossible. If we are to depend upon the history of this insect in the northeastern U.S. we can expect this epidemic to continue for a number of years with a great loss of timber. The present series of outbreaks of the spruce budworm in the north woods of Maine and eastern Canada started about 1910, and though on the wane at this time are still present in epidemic form. Nature will in time no doubt provide means of reducing this epidemic to a normal condition; but we have little idea when this will be accomplished. From the larvae collected in this area in July and shipped to this laboratory a few parasitic hymenoptera were reared. Though the percentage of parasitism was very small it is a great satisfaction to know that in their westward migration these insects have not escaped all their natural enemies.

*Douglas fir barkbeetle—*Dendroctonus pseudotsugae*.

The discouraging part of this examination, and especially the preparation of this report, is that the thoughts of artificial control for such an epidemic are practically impossible. To bring about the destruction of leaf-feeding insects a stomach poison must be applied to their food plants. To attempt to spray the trees within the area infested, though not impossible, is inconceivable because of the expense involved. The distribution of poison dusts from airplanes, and especially lighter-than-air machines, seems the most feasible thought at this time. However, the success of such a project would be the releasing of this dust at a very low elevation, and as the area infested is very rough and mountainous such an undertaking would be more than dangerous. Though several successful experiments of this character have been conducted in the eastern United States for the control of various leaf-feeding insect epidemics within small woodlots, the attempt to inaugurate this method of control for defoliating insects within our western forest, with our present equipment, is not feasible at this time. Furthermore, with the use of sprays or poison dust in such a manner, great care would need to be exercised to prevent a heavy mortality of the animals feeding upon the grass or shrubbery throughout the treated region.

It is regretted that until some feasible method is discovered for the control of defoliating insect epidemics within our western forests, the future of the timber stands of the Yellowstone Park and other areas infested in the west, must rest upon the hopes that the present epidemic will be controlled by natural agencies before a very great volume has been destroyed.

BARKBEETLES

Mountain pine beetle (Dendroctonus monticolae)

From eight to ten years ago in several areas of the park a large per cent of the mature lodgepole pine was destroyed by the mountain pine beetle. In the past few years there has been but little damage, however all the mature lodgepole pine stands should be carefully watched for evidence of a recurrence of this epidemic. Several freshly attacked trees were noted, and the red foliage of the trees attacked in 1922 was to be seen scattered throughout the park.

Douglas fir barkbeetle (Dendroctonus pseudotsugae)

At Camp Roosevelt there are several Douglas firs that have been killed by the Douglas fir beetle.* The trees containing the overwintering broods of this insect should be located and treated before the spring emergence. This work should be done as early as possible and not much later than the first of May. Inasmuch as the development of this insect from the egg to the new adult takes place between the bark and the wood, it is only necessary to cut and peel the bark from the infested portion of the bole, as exposure to the weather will kill the broods while they are in the larval or pupal stage. Detailed information relative to this matter will be forwarded to the superintendent of the park at a later date.

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*Exact number is not known and time was not available for an examination of the area.